



Understanding NFV and the MANO Stack

Dr. Syed Affan Ahmed

Adjunct Associate Professor

FAST-NU (Islamabad)

asyed@alumni.usc.edu

A grayscale portrait of a man with dark hair, wearing a light-colored collared shirt. The portrait is partially obscured by a dark diagonal shape that also serves as a background for the text on the right.

About me

PhD (CS) from USC, undergrad (EE) from EME. Avid technologist, researcher and academic. Built a top-quality research lab at FAST-NU and then migrated to industry.

Director Engineering at PLUMgrid, and NFV/SDN company until recently. Founded and head the Openstack Pakistan user-group.

Talk outline

Goals/outline

Why NFV?

Its motivation and challenges

ETSI NFV Stack and the MANO

Overview of MANO components

MANO implementations and current status

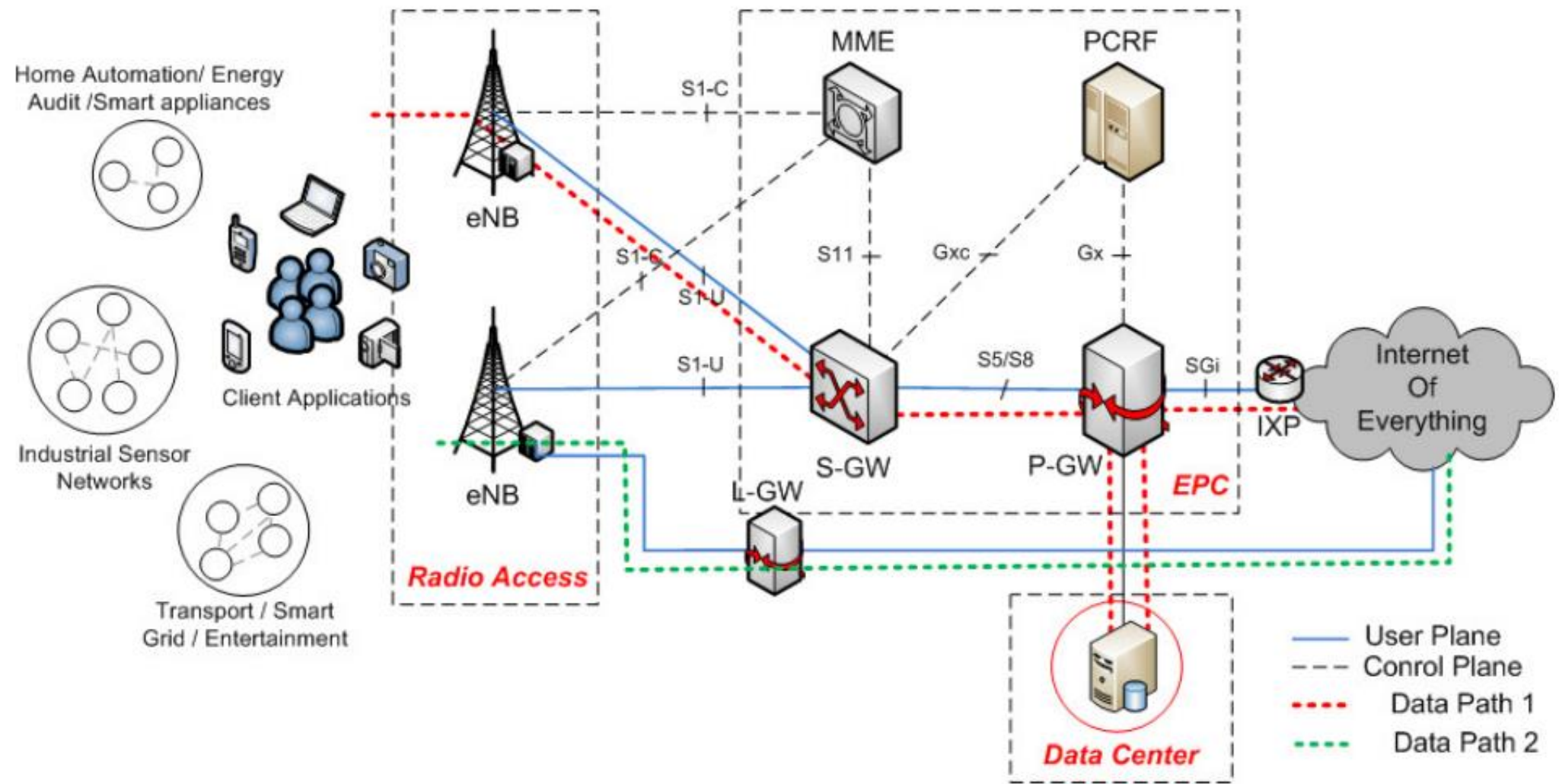
State of the MANO stack

OPNFV

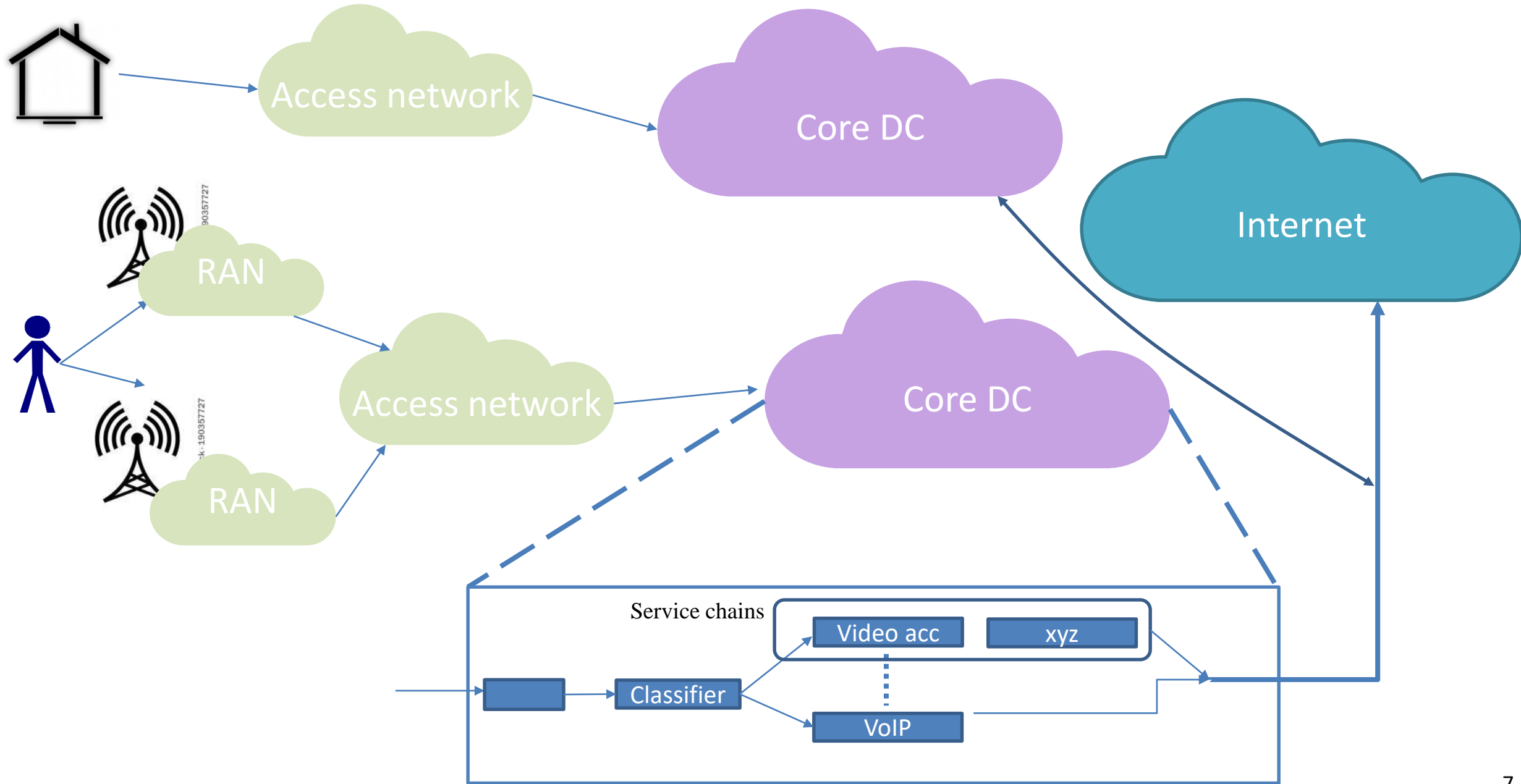
THE NFV buzz....

To NFV or not to NFV...

3GPP Communication ecosystem



Telecom Networks and their clouds



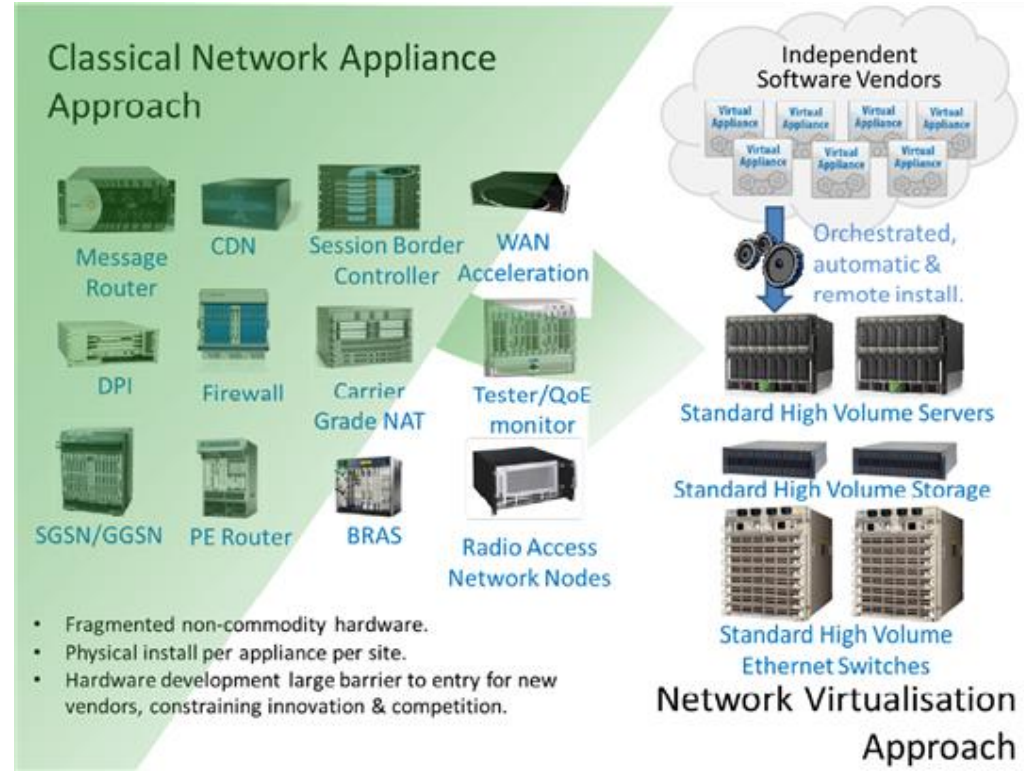
Network Function Virtualization (NFV)

Replace hardware network appliances with software

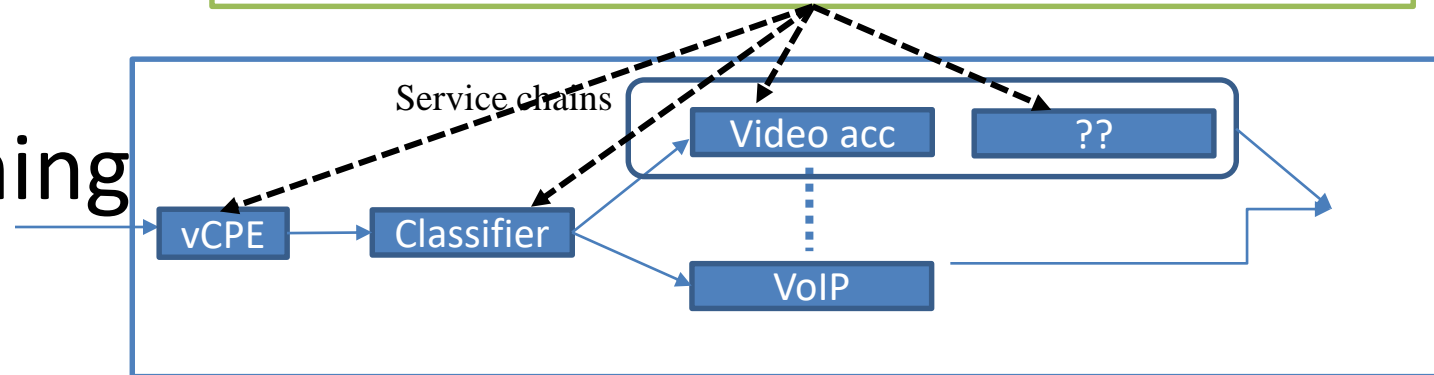
Deployable over commodity machines

Cost savings and no vendor lock-in

Agility in service provisioning



Each service/network function is in software



Legacy Limitation

Physical install appliance/site

Inefficient asset utilization

Development is time consuming, upgrade difficult

Limits modularity, vendor choice

Benefits of NFV

Flexibility / Extensibility

High asset utilization

Continuously deployed /upgraded

Achieve Modularity

Opens the competitive ' landscape

Innovative Ecosystem

NFV Challenges for Telco

Lots of promise

Business value; **real!**

Lots of Challenges

NFV = managing a “Carrier-grade” Cloud

Everything that was known, is now unknown



Technical Challenges for NFV

Carrier grade software (99.999% reliable)

How: *use micro-services, load balancing, and cloud-native VNFs
Containers, Hyper-convergence, and SDN for flexibility*

Security and visibility in managing virtual infra

How: *new tools and techniques to monitor virtual infra; group-based policies
failure prediction, virtual Tap, Isolation guarantees*

Packet processing at line rates, latency and jitter

How: *high speed packet processing on commodity machines
SR-IOV, fd.io/VPP, DPDK, IOVisor*

THE ETSI NFV Stack

aka a potpourri of difficult-to-remember-acronyms

A few keywords

Network Functions Virtualization (NFV):

principle of separating network functions from the hardware they run, i.e. Software Defined Functionality!

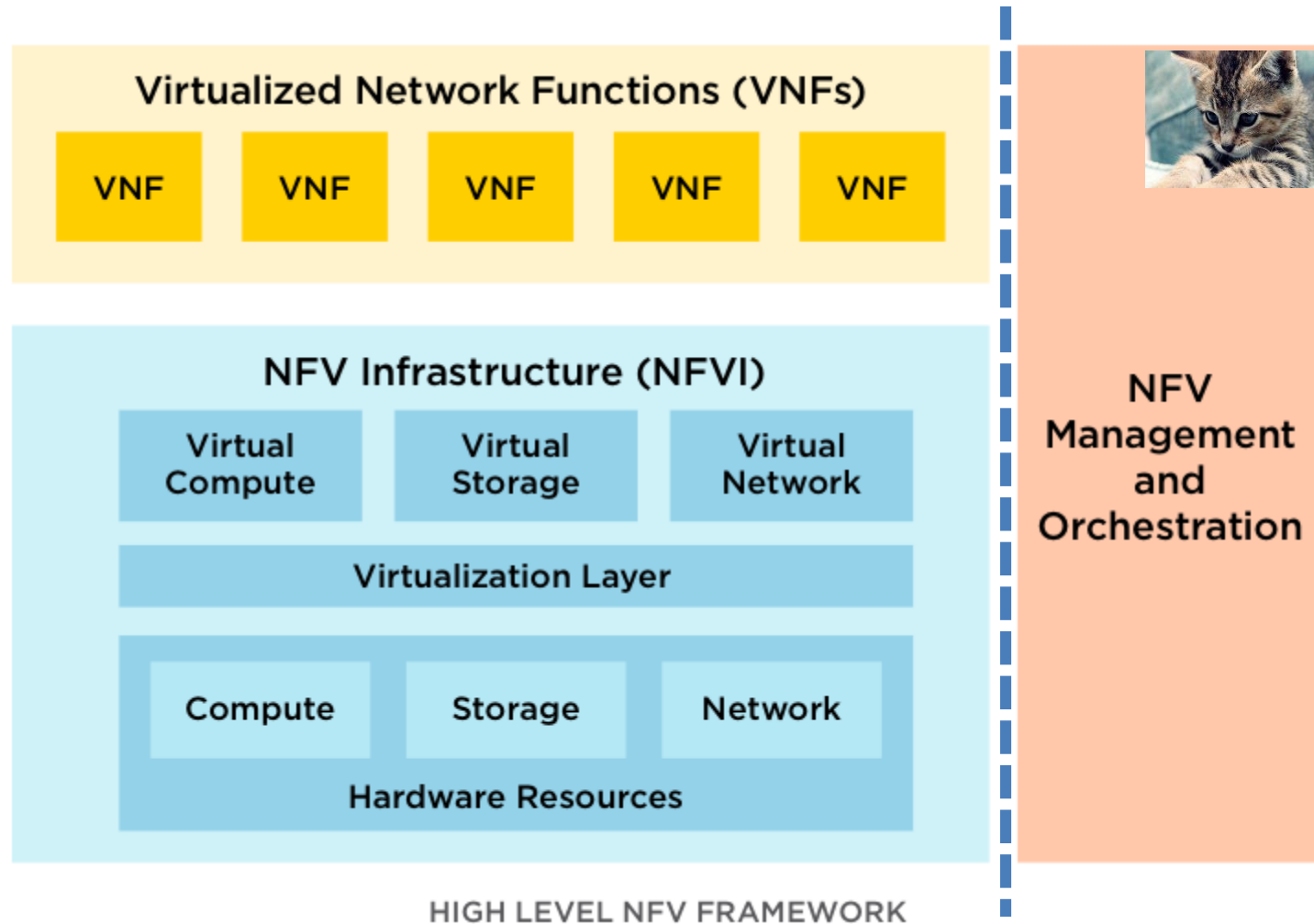
Virtual NF (VNF)

implementation of an NF as software on an NFV infrastructure

Network Service (NS)

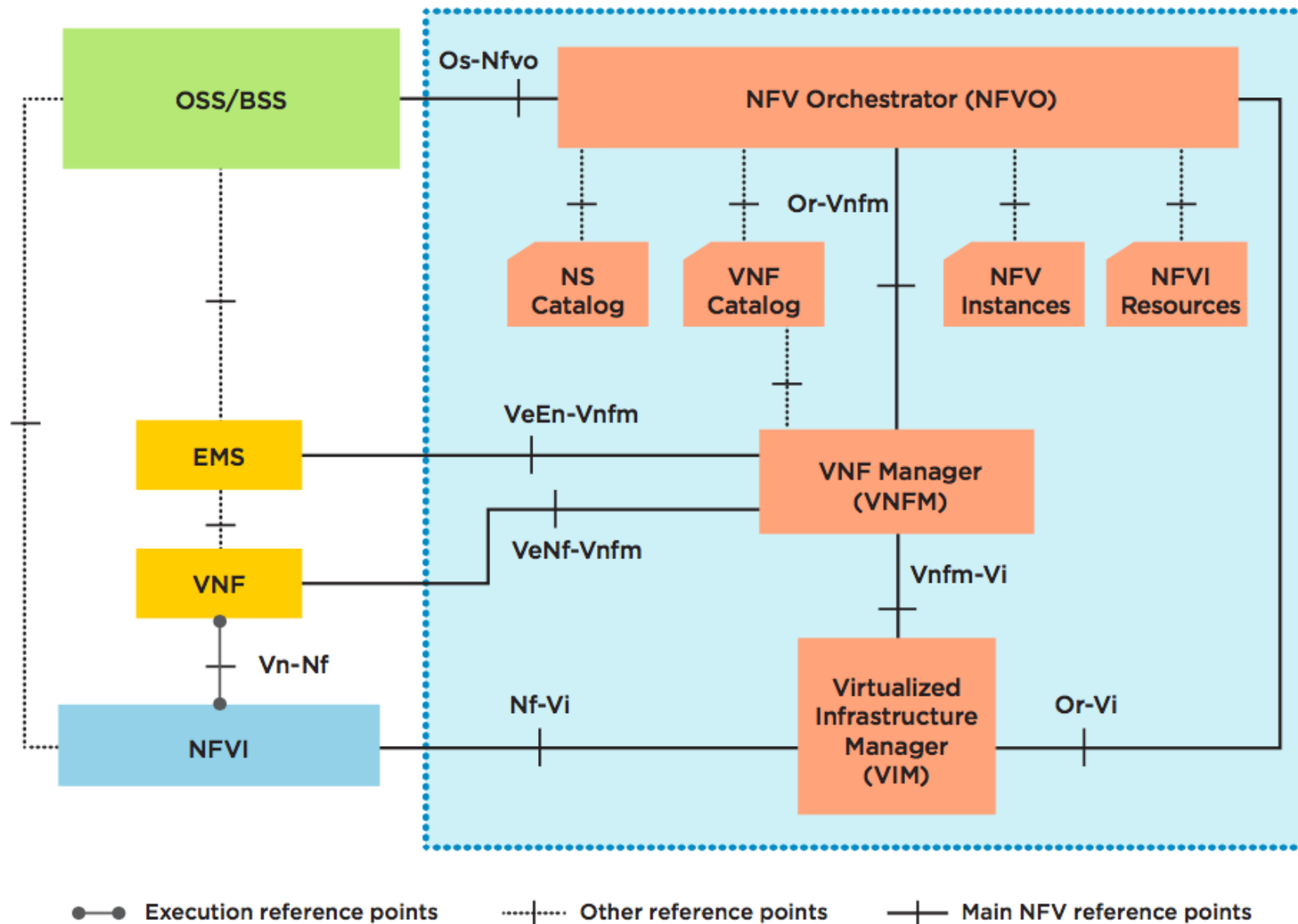
composition of Network Functions for an in-network service (e2e)

NFV High Level Framework



MANO *is to* NFV as Control Plane *is to* SDN.

NFV Arch details (Focusing on MANO)



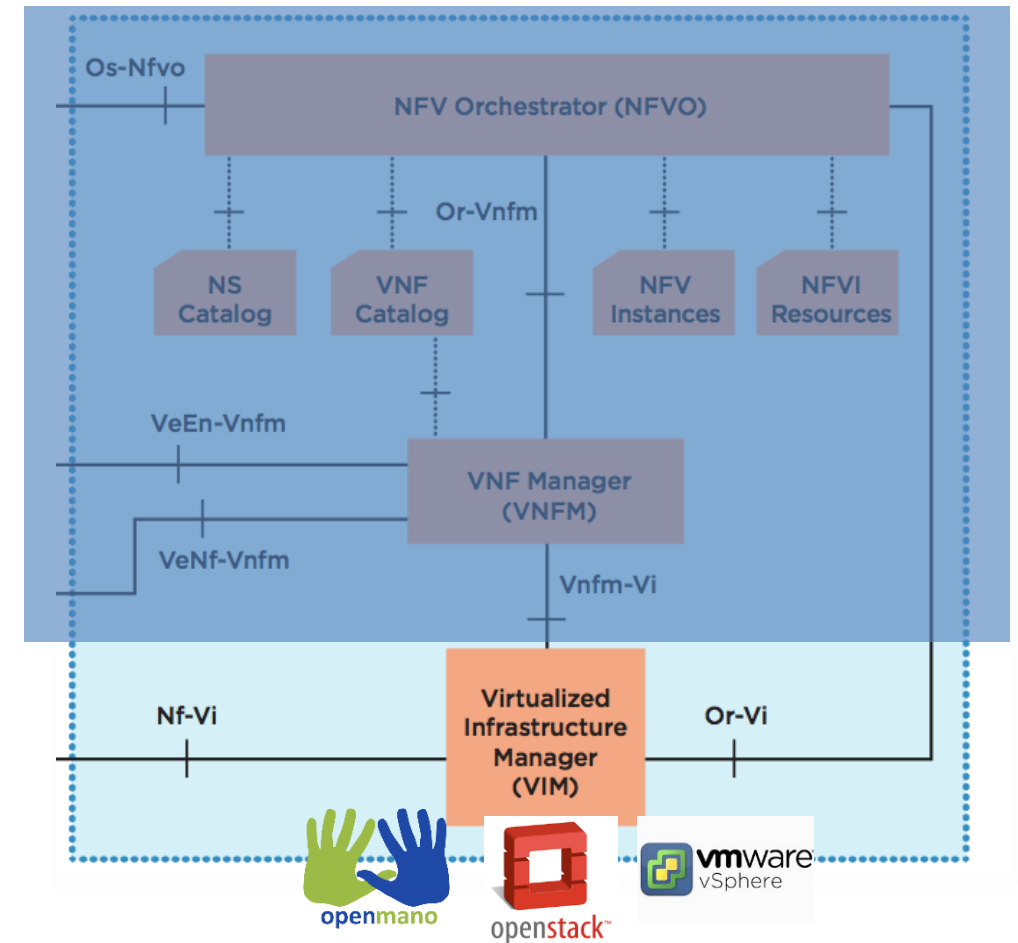
A graphical depiction of the NFV architecture, with the MANO components on the right side in blue.

Virtual Infrastructure Manager (VIM)

Manages *life cycle* of virtual resources in an NFVI domain.

Keeps inventory of virtual machines (VMs) associated with physical resources.

APIs to expose physical and virtual resources to other management systems.



For IT people, it's just a CMS

VNF Manager

VNFM manages life cycle of VNFs.

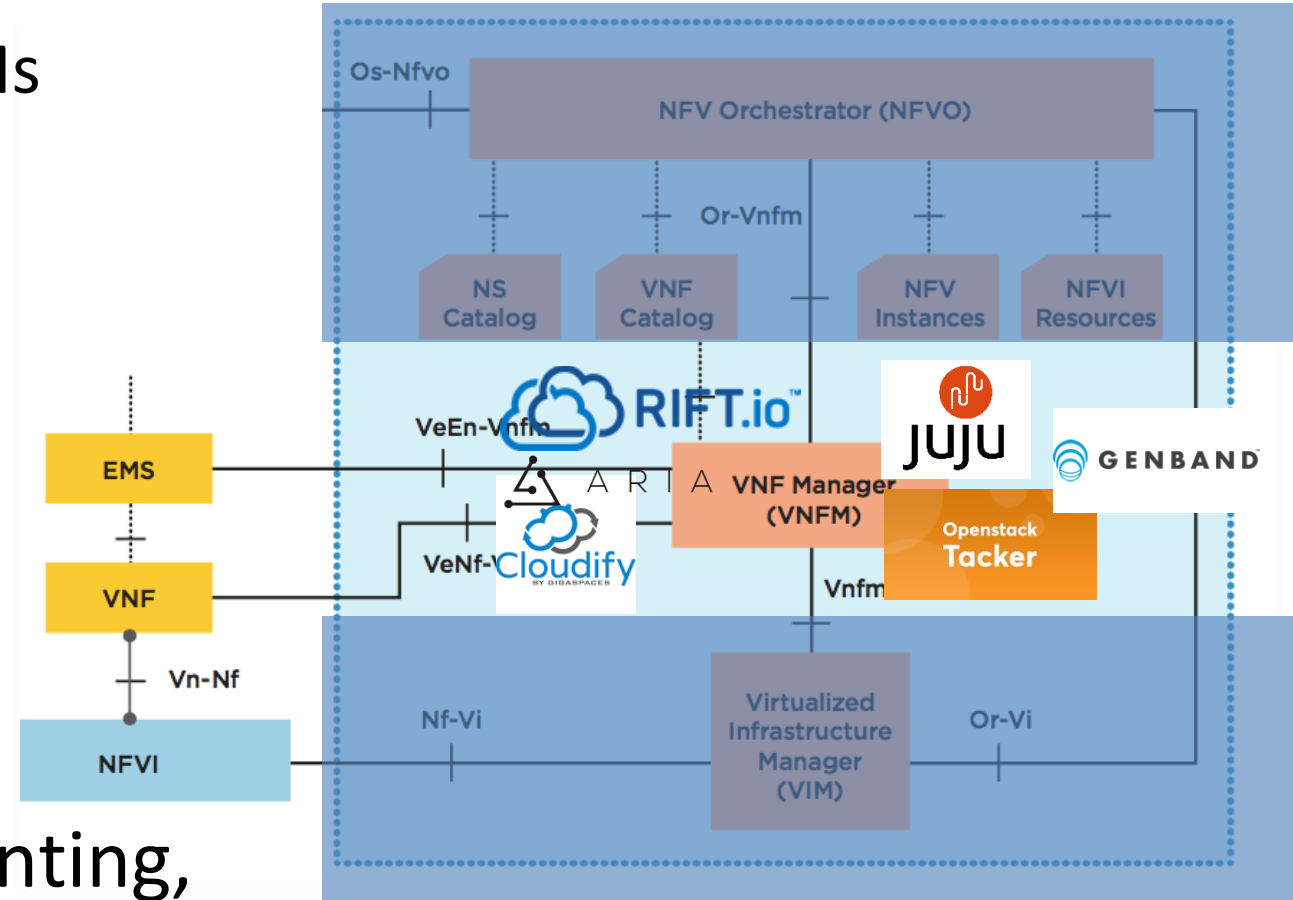
VNF resources managed by VMs

Generic vs application specific

It scales up/down VNFs

FCAPS of VNF

fault, configuration, accounting,
performance, security management

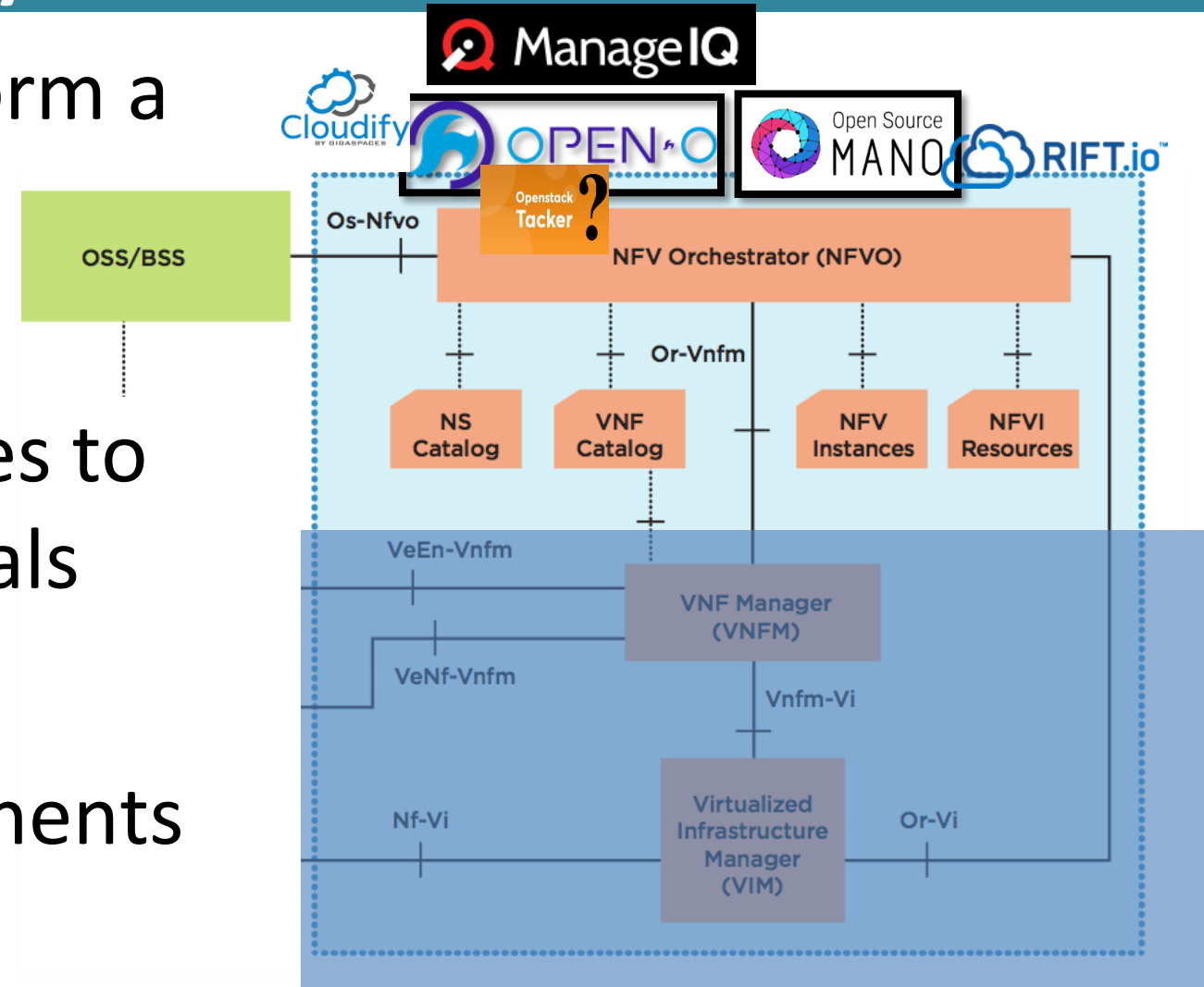


NFV Orchestrator (NFVO): Why Needed?

Stringing VNFs together to form a service chain

Managing multi-site resources to best meet operator/telco goals

Integration with SDN components important



Addressing the State of MANO

The many ways in which NFV is being implemented!

NFVI and VIM are the lowest layer, generally separable

- Openstack/VMWare (a lifeline for Openstack viz the Docker craze!)

VNFM can be generic, OR provided by VNF/app developers

- A VNFM typically is for a single VIM/Cloud (some confusion)

NFVO is the most “in-the-air” at this point

- likely a different space for startups, innovation (Rift, Aria)
 - Standardizing modeling language (TOSCA, YAML, NETCONF/YANG)
- selection of SDN and VIM(s) can be made here (multi-site/multi-cloud)
- unclear if applications over NFV go through OSS-NFVO or a different northbound API will exist?

Multi hypervisor, Multi-VIM, Multi-VNFM

A word of caution

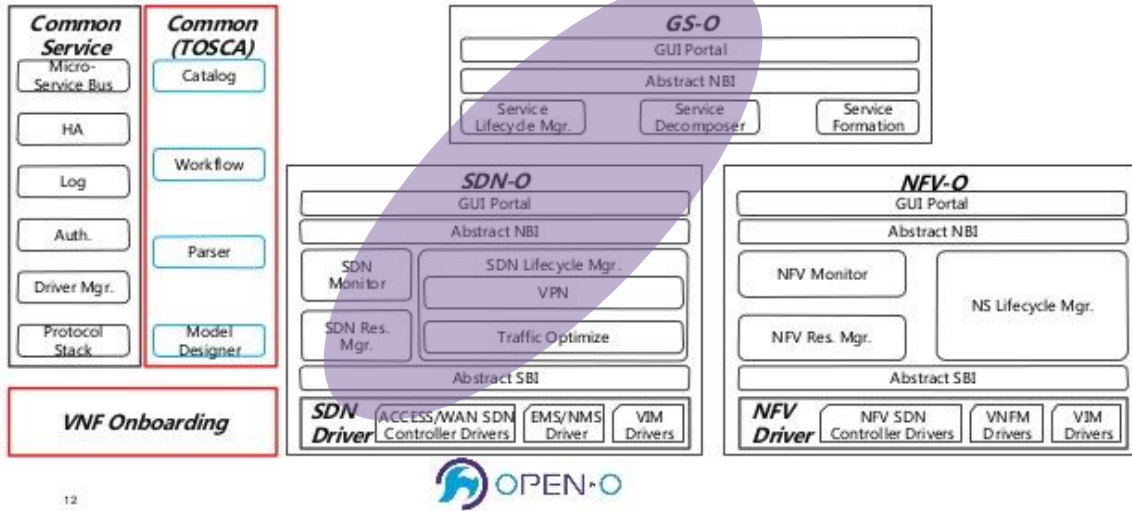
Lots of “Open” implementations that are trying to standardize around the APIs to talk between managers

open-source vs standards

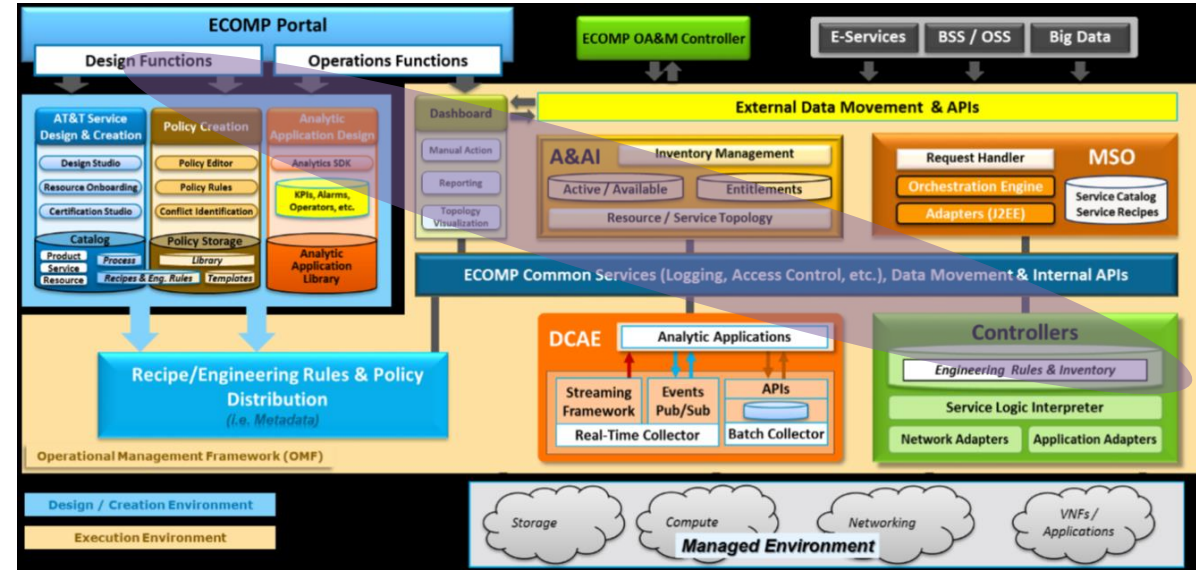
As of Dec 2016, most of the “implementations” of MANO layers have varying levels of compliance and interpretation

e.g. AT&T’s ECOMP, Rift.ware, Cloudfify/Aria

OPEN-O Release 1 Planning



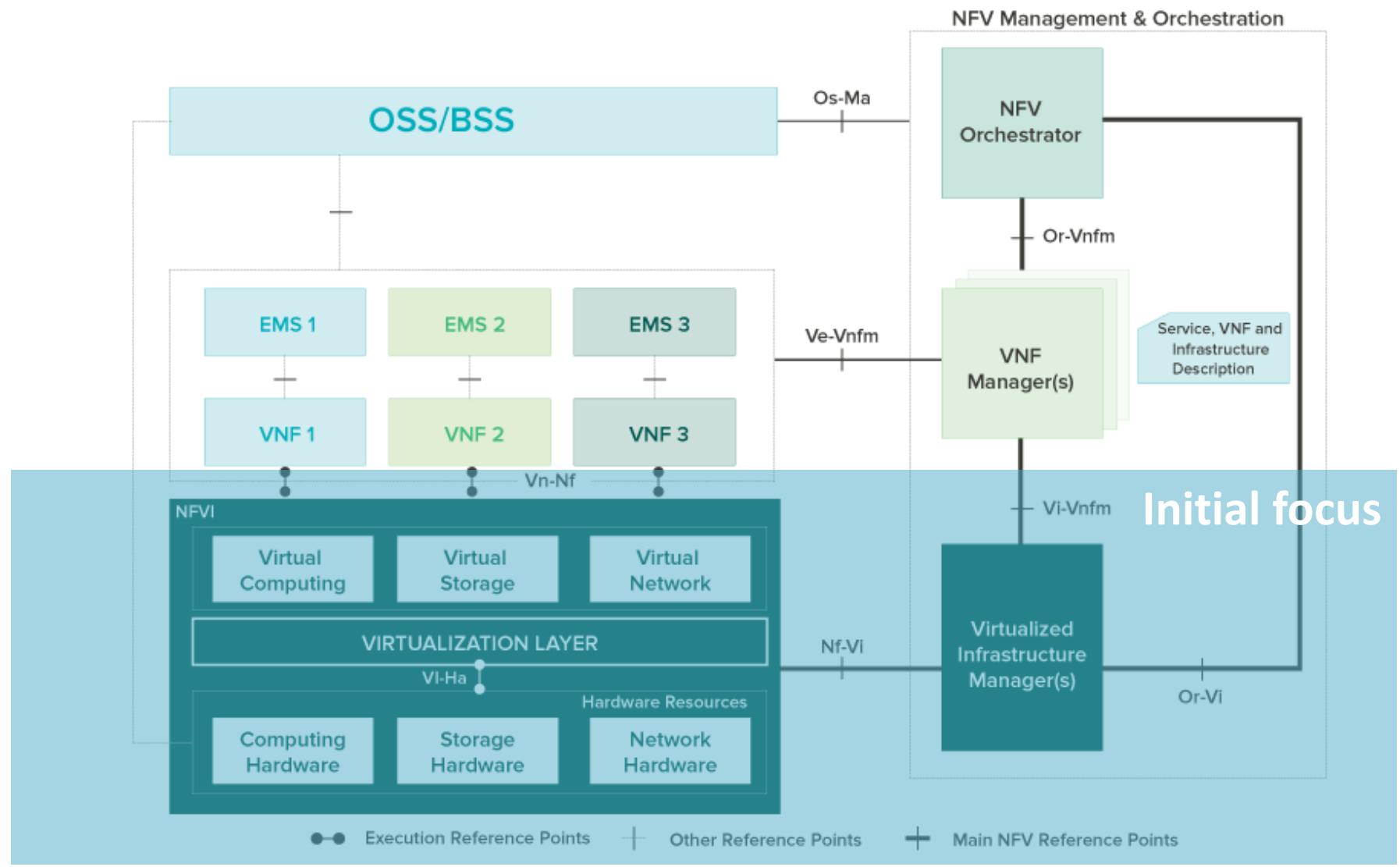
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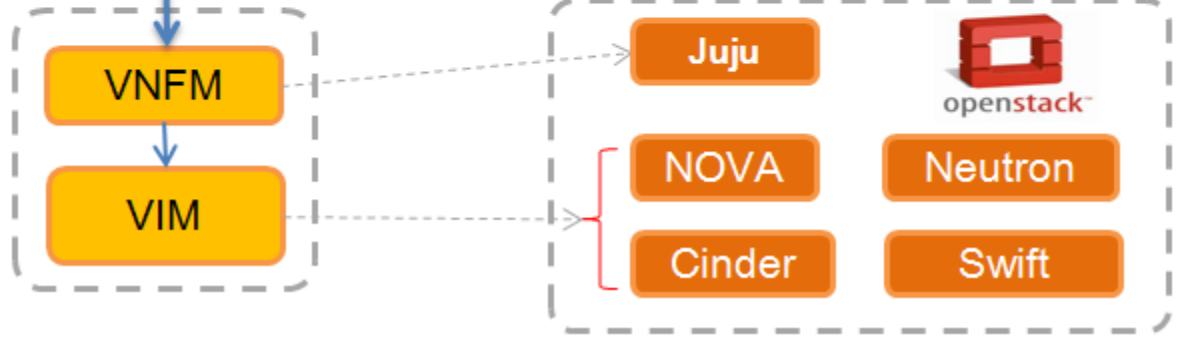
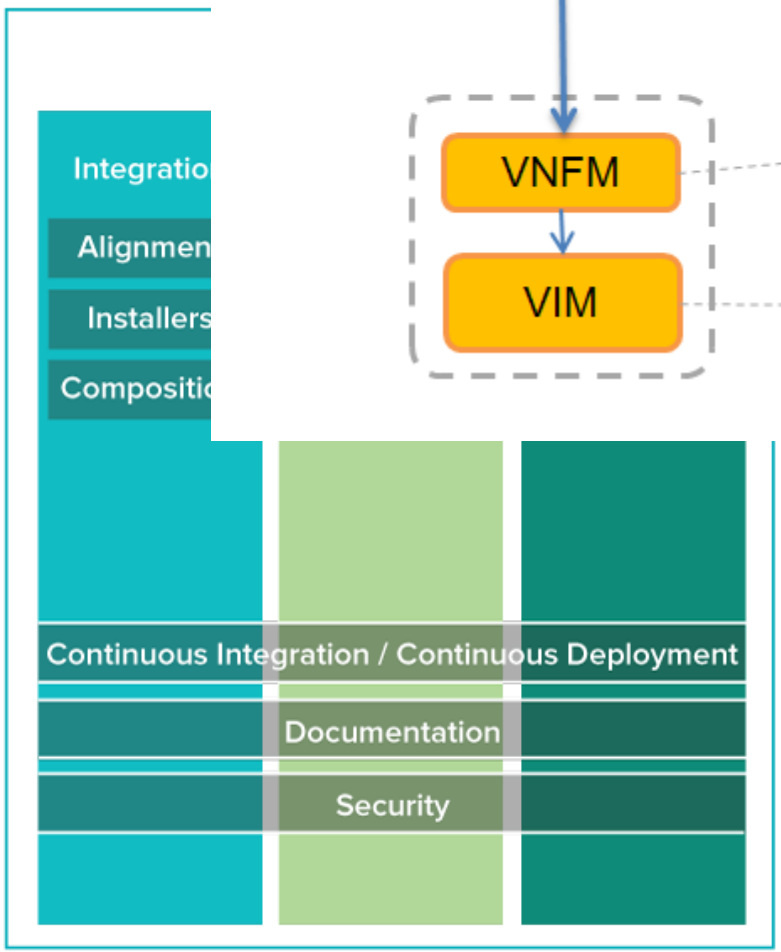
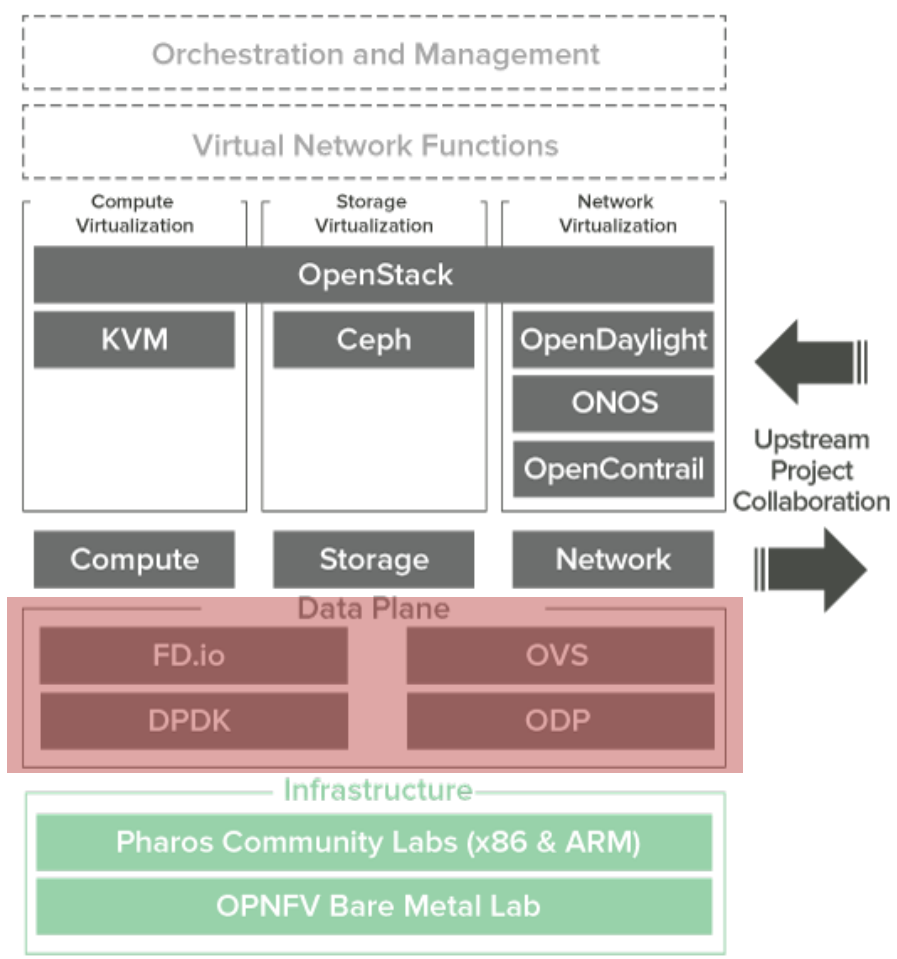
Other takes on NFV orchestration

**OPNFV: Open source,
meet NFV**

Initial Focus



What is OPNFV?



In Colorado the focus has started to move towards MANO

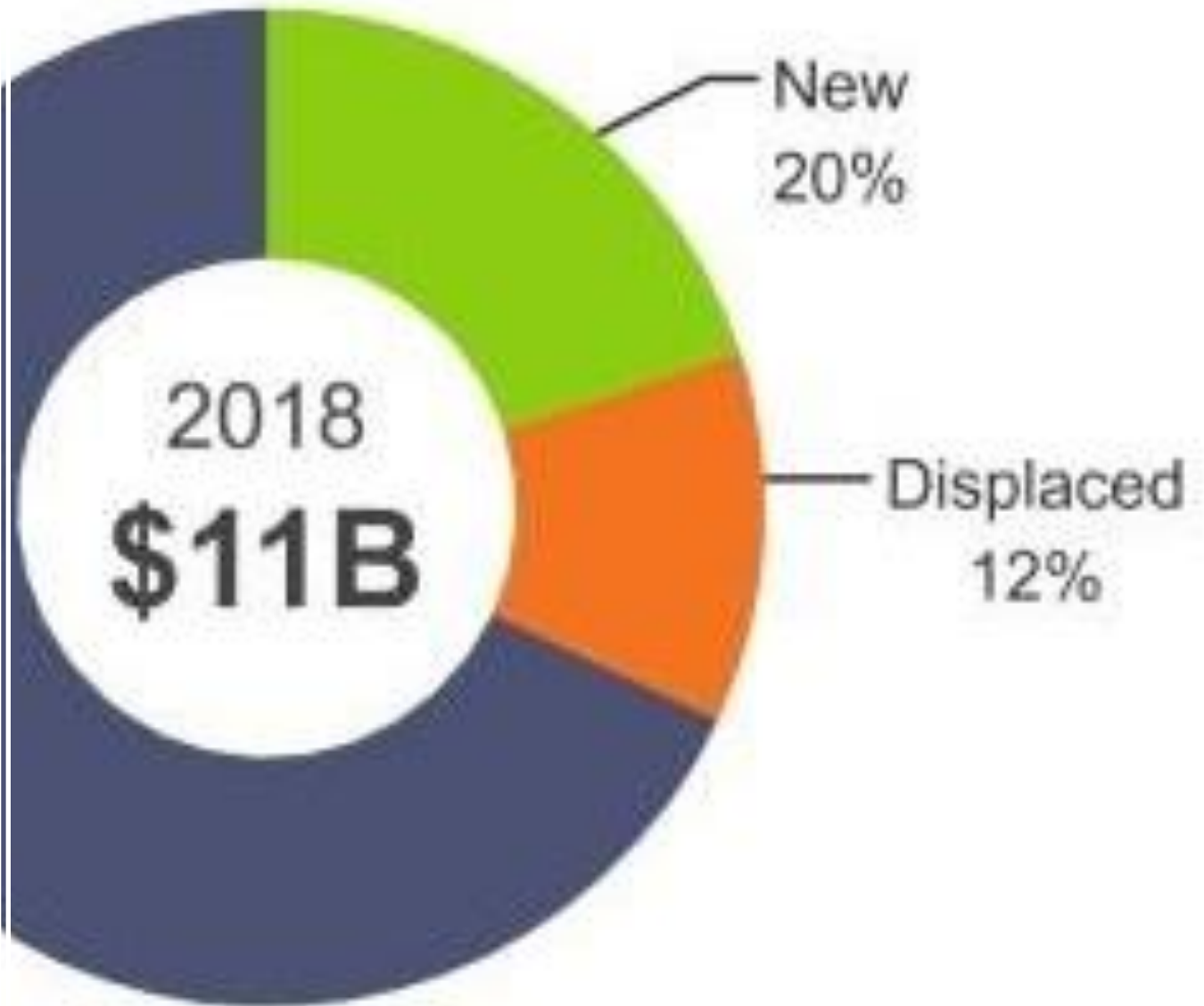
that are new, displaced, and from existing market segments

Conclusion

NFV is real, so are its challenges

NFV standardization is happening via code

Telcos need to quickly understand the landscape



Thank you!

asyed@alumni.usc.edu
@aintiha